This manuscript presents a model-based analysis on aerosol-radiation-boundary layer interactions and feedbacks, with a focus on secondary sulfate and nitrate formation under polluted conditions. The topic is original and the paper appears scientifically sound. I have a few, mostly minor, issues to be considered before acceptance of this paper for publication.

Response: We appreciate the reviewer's kind effort and constructive comments. We have implemented all suggestions for improvement in the revised manuscript. Please kindly find our point-by-point responses listed below. The reviewer's comments are in Italic and blue followed by our responses and revisions.

Scientific issues:

main comment concerns the structure of section 3. Now there is three longish paragraph discussing sulfate formation, then two short paragraphs on oxidants and AOD, and finally something about nitrate formation. I wonder whether this is the best way of presenting the results for a reader to easily follow the discussion. Furthermore, there appears to be some unnecessary repetition of text in this section. For example, the relative roles of ADEP and ADED in forming sulfate in summer and winter is discussed in three places (lines 146-147, 159-161, 183-184).

Response: Thanks for your comments. As you suggested, we have modified the section 3 to make a clearer presentation of results for readers to follow. We have added two figures showing ADE impacts on sulfate and nitrate concentration in revised manuscript (Fig. 4 and 7 in revised manuscript), making it easier to discuss the overall ADE impacts than using the figure of IPRs (Fig. 4 and 7 in original manuscript where the sum of every bar represents the overall ADE impact). Also, we have moved the figure of oxidants and related discussion to SI and added more description regarding ADE impacts on nitrate. Furthermore, we have polished the description of sulfate formation part to make it easier to follow.

As for the unnecessary repetition, we have checked the structure of section 3 and found that there are some similar descriptive sentences since the overall pattern and detailed processes are discussed separately where same phenomenon may be mentioned in both paragraphs. We have carefully looked through the section 3 and reorganized the description of results avoiding unnecessary repetition according to your suggestion.

The new Figure 4 and 7 with related revision of text are shown below and in revised manuscript.

Line 140, Page 4
"*As shown in Fig. 4, ADE affects sulfate through both photolysis and dynamics in January, leading to a decrease of sulfate formation rate in all layers...*"

Line 174, Page 4

"*The ADE impacts on nitrate are then investigated. Vertical profile of nitrate affected by ADE is presented in Fig. 7. Overall, ADED makes stronger influence on nitrate concentration than ADEP in both winter and summer. ADEP slightly reduces nitrate concentration near surface in both seasons (Fig. 7a and 7d). As for ADED, it generally lower the nitrate concentration in winter (Fig. 7b) and the largest reduction occurs above PBL (at around 900 m). During summer, ADED exhibits a promotion effect on nitrate especially in near surface layers (Fig. 7e).*"

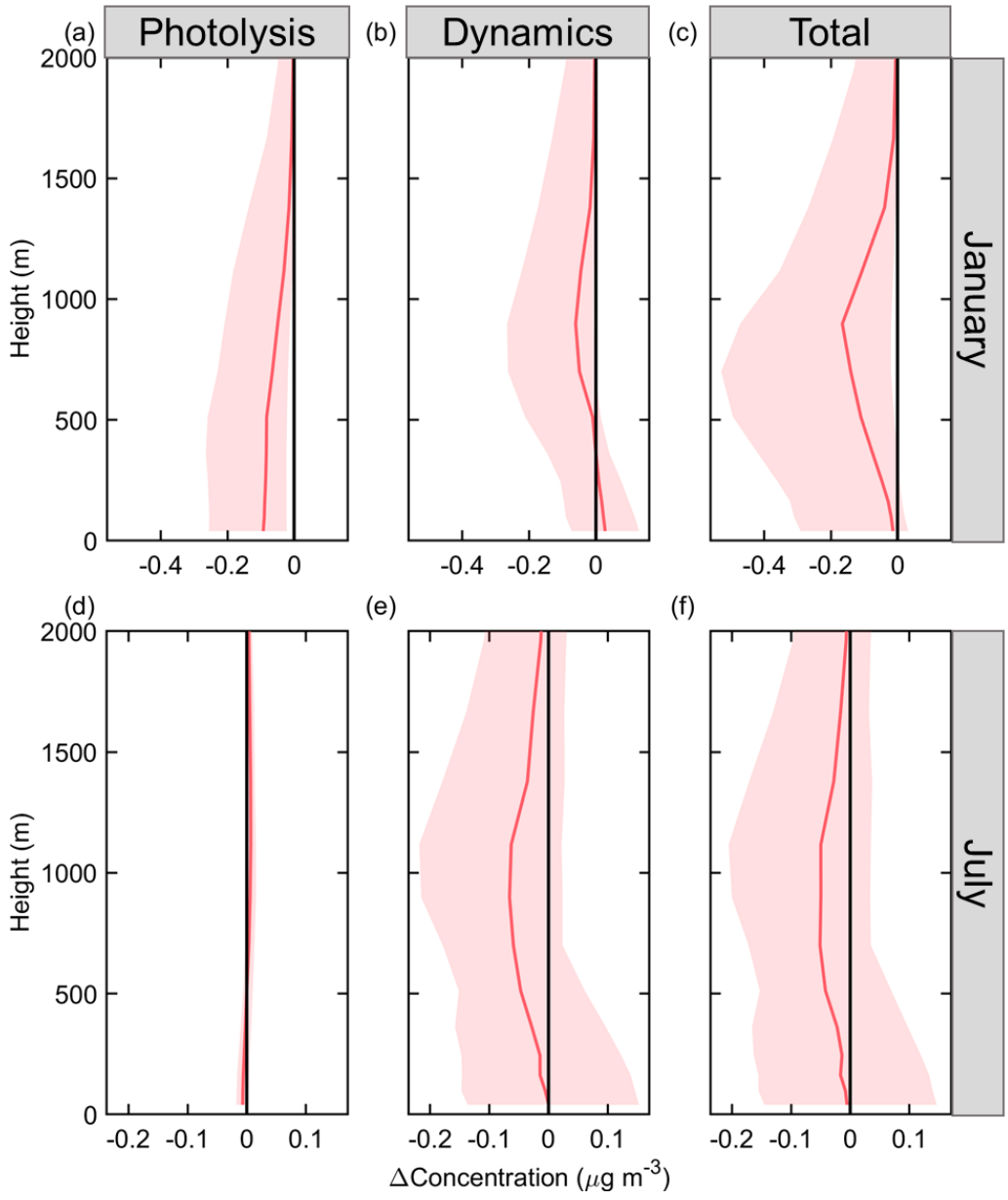

Figure 4: Vertical profile of sulfate concentration change to ADE in Jing-Jin-Ji(JJJ) region at noontime in January (a b c) and July (d e f).

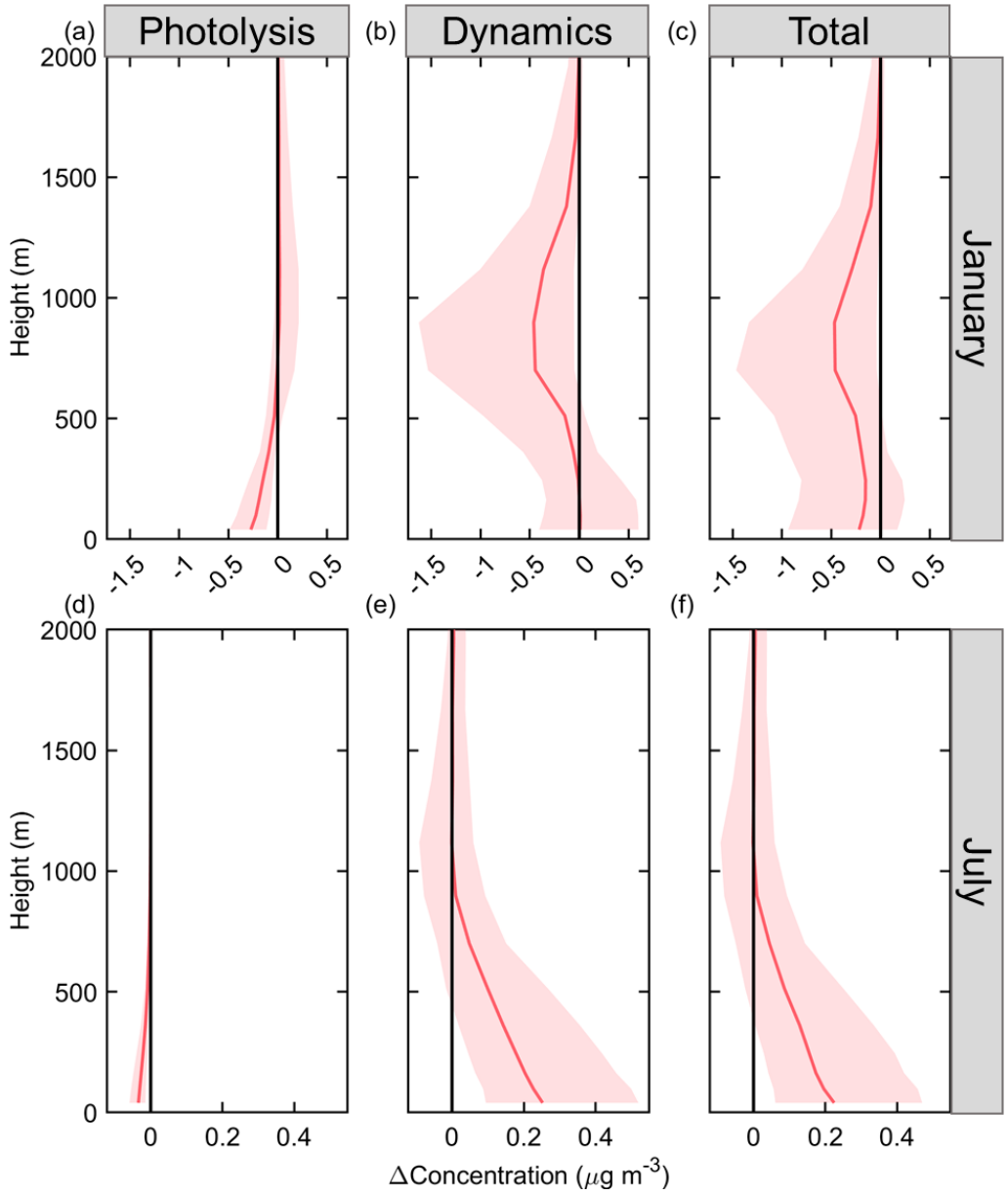

Figure 7: Vertical profile of nitrate concentration change to ADE in Jing-Jin-Ji(JJJ) region at noontime in January (a b c) and July (d e f).

Related to the previous comment, the authors refer to section 3.2 on lines 201 and 206, a section which does not exist. I wonder whether some earlier versions of this paper have had structure different from the current one.

Response: Thanks for your comment. Indeed, section 3 was divided into 3 parts in early version. We have revised the related part in manuscript.

The list of compounds given on line 192 certainly participate in atmospheric oxidation reactions, but not all of them (e.g. NO2 and HNO3) can be considered as oxidants. Please reword and modify this part of the text accordingly.

Response: Thanks for your suggestion. We use ADE on production rate of reacted OH instead of Total Ox in revised manuscript. Further, we have moved the discussion of oxidants to SI in manuscript as mentioned in above response.

Line 41 Page 2 in SI.
"*To further investigate the impacts of ADE on atmospheric chemistry, we examined the changes in production rates of new reacted OH, shown in Fig S5.*"

Essentially the same thing is stated on lines 230-231 and 235-236. Please avoid repetition. Also, I would suggest some rewording: …more complicated than its impact on primary aerosol.

Response: Thanks for your suggestion. As mention in above response, we have checked the results and conclusion part and removed repeated sentences accordingly.

Minor technical issues:

line 48: … observations…

Response: Thanks for your suggestion. We have revised it in manuscript.

section 2 title should read "Methods"

Response: Thanks. We have revised it according to your comment.

line 127: The PBL height …

Response: We appreciate your comment. We have revised it in manuscript.

lines 135, 137 and 138: in the near-surface layer

Response: Thanks. We have revised it in manuscript.

line 185: … effect on …

Response: Thanks for your comment. We have revised our manuscript accordingly.

line 207: diffuse solar radiation

Response: Thanks for your suggestion. We have revised it in manuscript.

Figure 8 is referred to before Figure 7. Please check out that they are referred to correctly in the paragraph on lines 212-227. If necessary, change the order of figures

such that they are referred to in correct numerical order.

Response: Thanks. We have revised it in manuscript according to your suggestion.